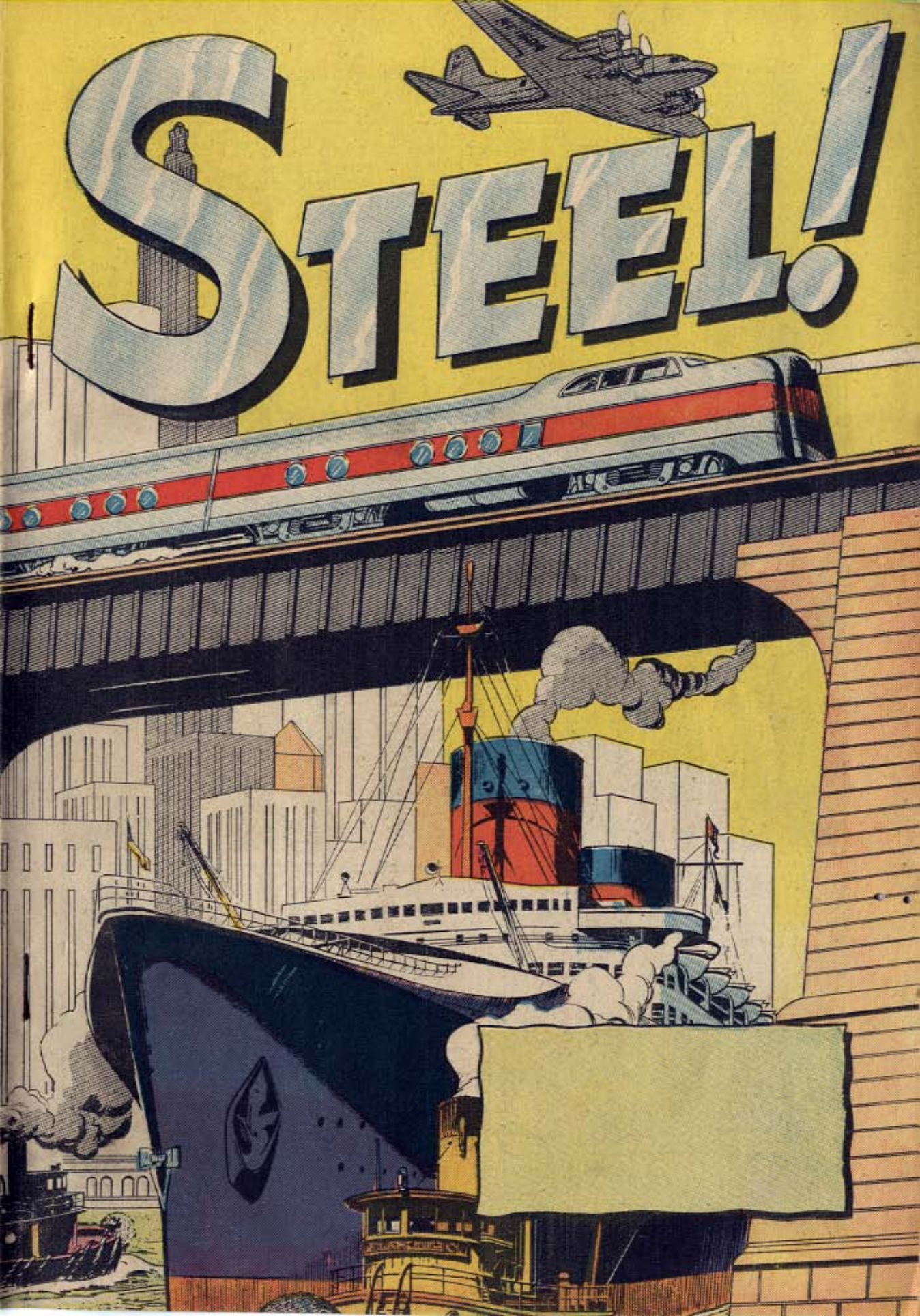
STEEL!

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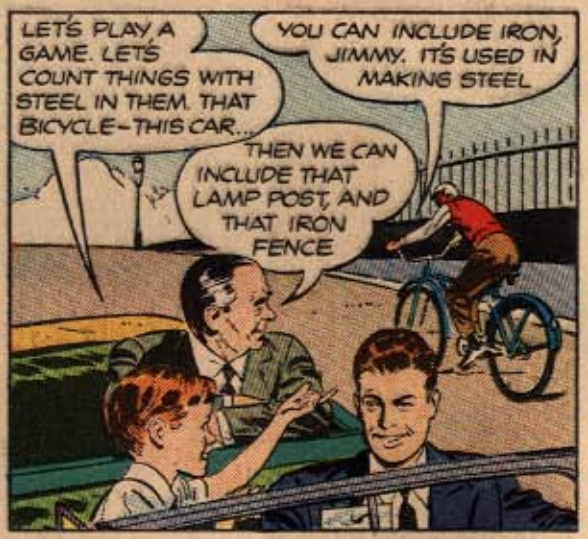
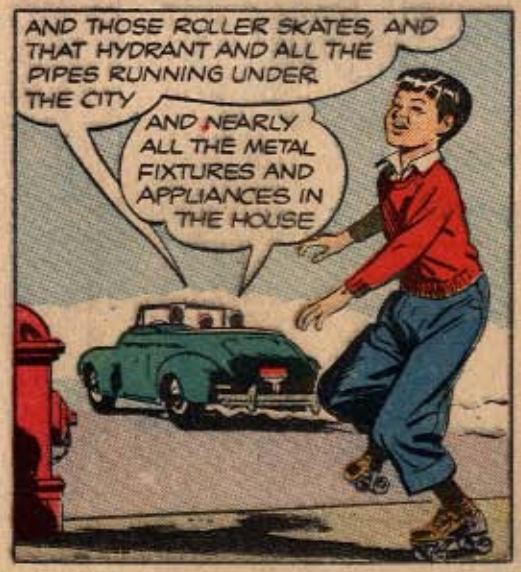
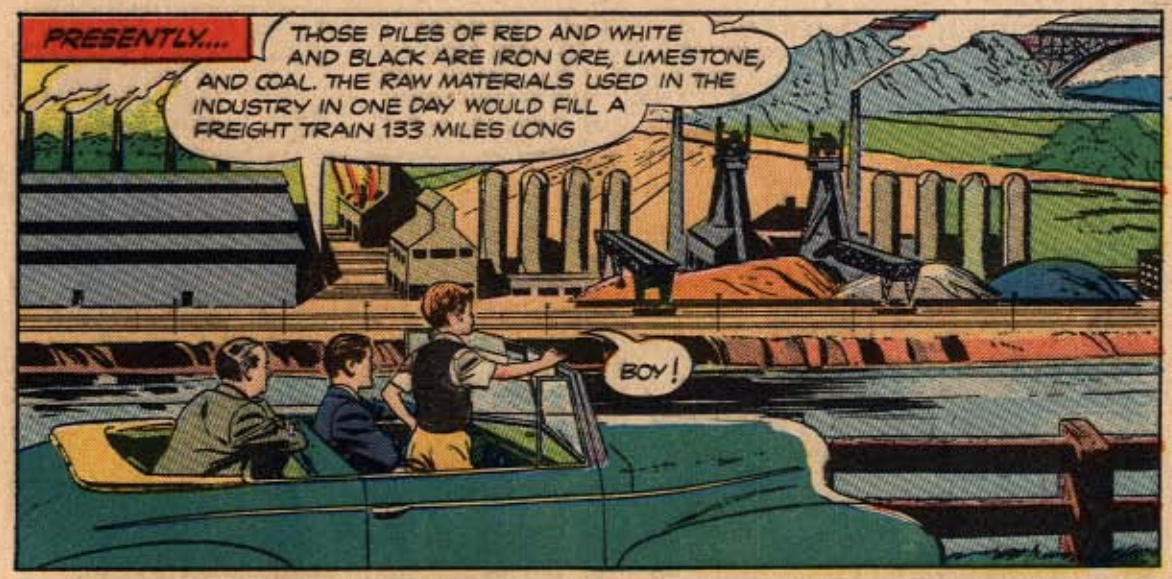
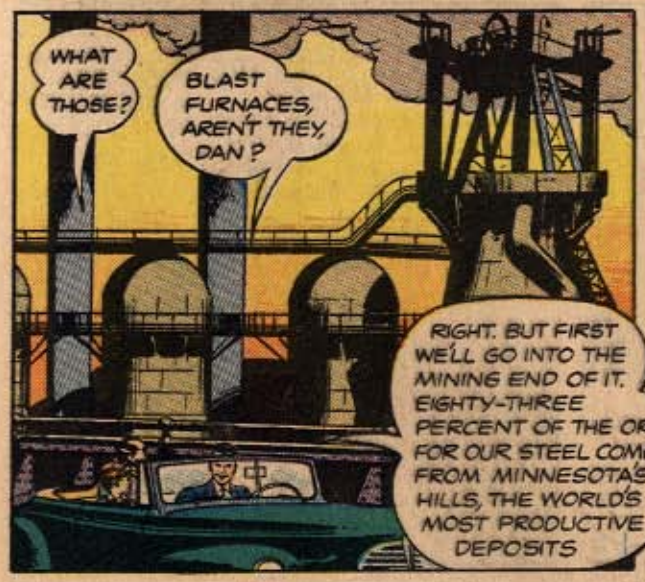
JIMMY GETS HIS STORY

STORY BY
FRANK KOLARS,
INSTRUCTOR, SCHOOL
OF JOURNALISM—
HUNTER COLLEGE

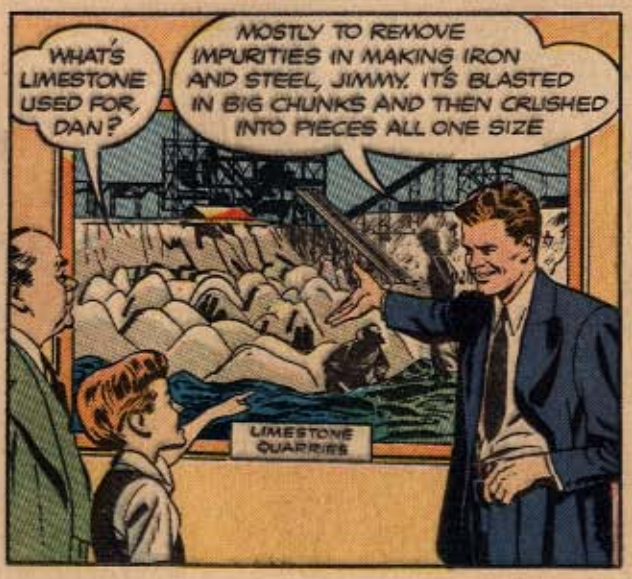





PRESENTLY....
THOSE PILES OF RED AND WHITE AND BLACK ARE IRON ORE, LIMESTONE, AND COAL. THE RAW MATERIALS USED IN THE INDUSTRY IN ONE DAY WOULD FILL A FREIGHT TRAIN 133 MILES LONG
BOY!


WHAT ARE THOSE?
BLAST FURNACES, AREN'T THEY, DAN?
RIGHT. BUT FIRST WE'LL GO INTO THE MINING END OF IT. EIGHTY-THREE PERCENT OF THE ORE FOR OUR STEEL COMES FROM MINNESOTA'S HILLS, THE WORLD'S MOST PRODUCTIVE DEPOSITS

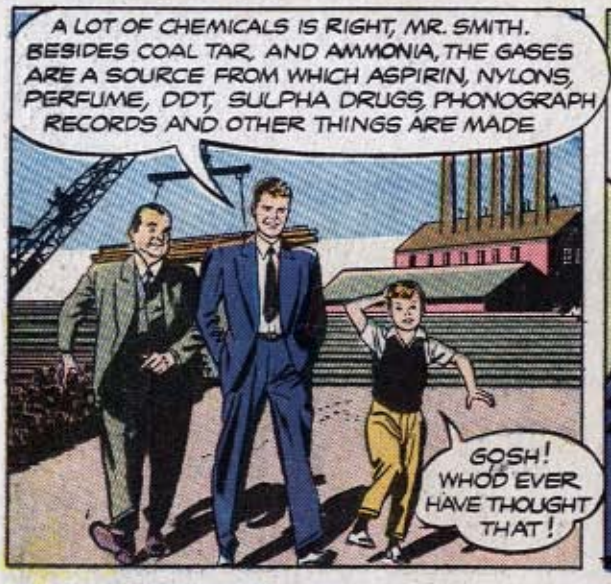
HERE'S A SKETCH OF ONE OF OUR OPEN PIT ORE MINES. THOSE POWER SHOVELS DO A JOB. AN ELECTRIC LOADER SHOVEL TAKES 17 TONS AT ONE BITE
GEE, THOSE PITS GO DOWN DEEP!
THREE HUNDRED AND FIFTY FEET I THINK YOU ONCE TOLD ME, DAN


WHAT'S LIMESTONE USED FOR, DAN?
MOSTLY TO REMOVE IMPURITIES IN MAKING IRON AND STEEL, JIMMY. IT'S BLASTED IN BIG CHUNKS AND THEN CRUSHED INTO PIECES ALL ONE SIZE
LIMESTONE QUARRIES

CONCERNING COAL, THERE'S VERY LITTLE PICK-AND-SHOVEL WORK THESE DAYS. THAT MACHINE CUTS OUT BIG BLOCKS OF COAL, LATER TO BE BLASTED INTO SMALL PIECES

COAL ARRIVES AT THE STEEL PLANT BY RIVER BOATS AND BARGES. WHEN IT GETS HERE IT'S MADE INTO COKE. COKE IS COAL WITH ITS GASES, AND OTHER IMPURITIES "TOASTED" AWAY IN THE OVENS
WHY DO THEY HAVE TO DO THAT, DAN?

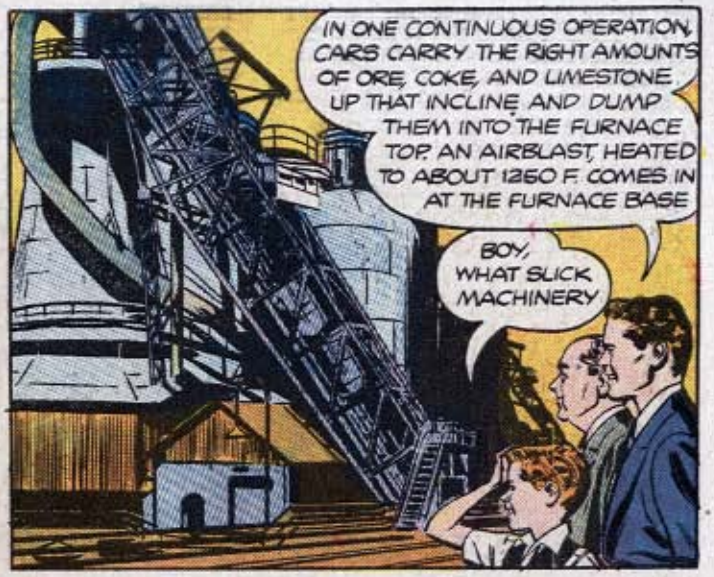
IT MAKES BETTER IRON AND STEEL, JIMMY. LET'S WATCH THIS COKE OVEN UNLOAD
THEY GET A LOT OF CHEMICALS FROM THE COKING PROCESS, DON'T THEY, DAN?

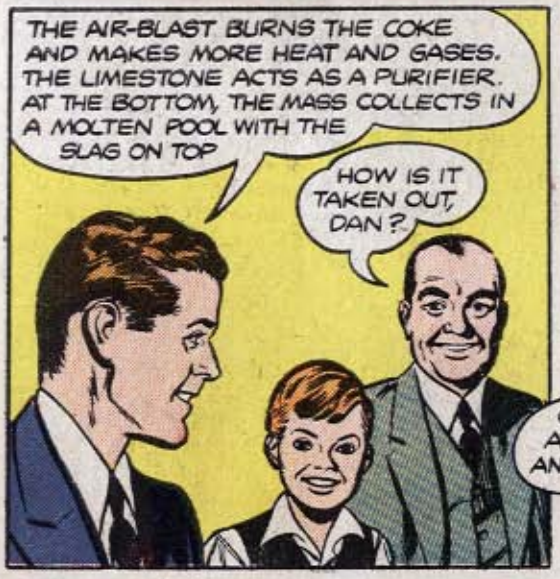

A LOT OF CHEMICALS IS RIGHT, MR. SMITH. BESIDES COAL TAR, AND AMMONIA, THE GASES ARE A SOURCE FROM WHICH ASPIRIN, NYLONS, PERFUME, DDT, SULPHA DRUGS, PHONOGRAPH RECORDS AND OTHER THINGS ARE MADE
GOSH! WHO'D EVER HAVE THOUGHT THAT!

NOW WE'RE READY FOR THE BLAST FURNACES, THEY'RE AS HIGH AS A TEN-STORY BUILDING. HUGE STEEL SHELLS, LINED WITH FIRE-BRICK. THEY MAKE THE IRON
I THOUGHT STEEL WAS MADE RIGHT OFF

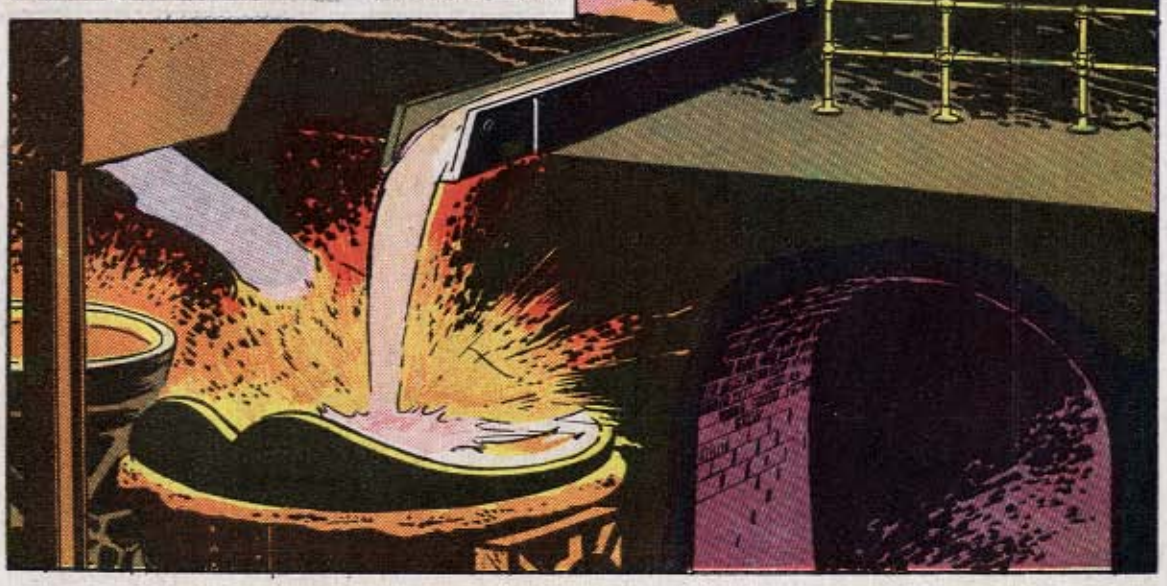
IRON COMES FIRST, JIMMY. HERE ARE THE BLAST FURNACES. IN ONE YEAR THE STEEL INDUSTRY USES ENOUGH BRICK REUNING TO BUILD A CITY OF 15,000 HOMES
THOSE MONSTERS MUST TAKE QUITE A LOAD OF RAW MATERIALS
GOSH YES

THEY DO TAKE A LOAD. A LARGE MODERN FURNACE PRODUCES 1200 TONS OF PIG IRON EVERY TWENTY-FOUR HOURS. I'LL SHOW YOU THE LOADING OR CHARGING MACHINERY


IN ONE CONTINUOUS OPERATION, CARS CARRY THE RIGHT AMOUNTS OF ORE, COKE, AND LIMESTONE UP THAT INCLINE AND DUMP THEM INTO THE FURNACE TOP. AN AIRBLAST, HEATED TO ABOUT 1250 F. COMES IN AT THE FURNACE BASE
BOY, WHAT SLICK MACHINERY


THE AIR-BLAST BURNS THE COKE AND MAKES MORE HEAT AND GASES. THE LIMESTONE ACTS AS A PURIFIER. AT THE BOTTOM, THE MASS COLLECTS IN A MOLTEN POOL WITH THE SLAG ON TOP
HOW IS IT TAKEN OUT, DAN?

THE MOLTEN IRON IS DRAINED OFF AT THE BOTTOM BY "TAPPING" A CLAY PLUG WITH AN OXYGEN BURNER AT TWENTY-FEET DISTANCE. THOSE BIG LADLES CARRY IT TO A KIND OF HUGE "THERMOS BOTTLE" CALLED A "MIXER," WHICH KEEPS THE METAL HOT UNTIL IT IS USED FOR MAKING STEEL
GOLLY! LOOK AT IT BUBBLE AND SPARKLE



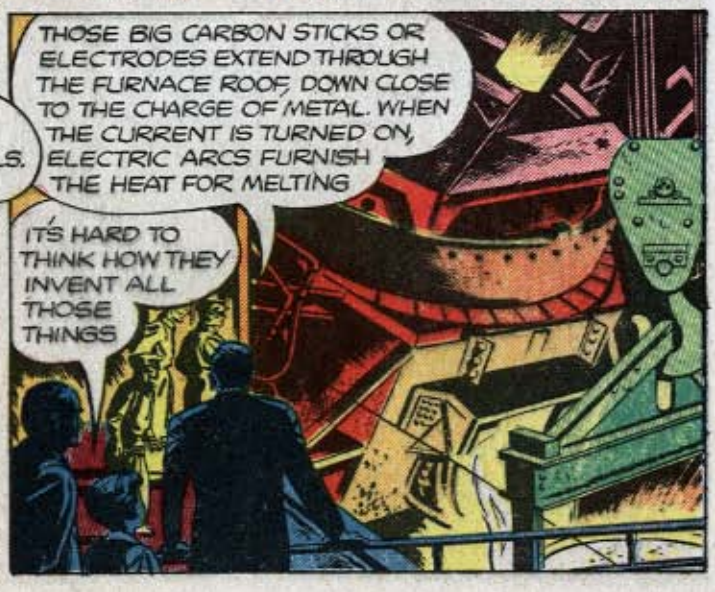
THAT OXYGEN FLAME, TAPPING THE PLUG AT TWENTY FEET IS SOMETHING. YOU SEEM TO HAVE THINGS DOWN TO A "NO-RISK" BASIS
YES, NATIONAL SAFETY COUNCIL RECORDS SHOW THAT THE STEEL INDUSTRY IS ONE OF THE FIVE SAFEST PLACES TO WORK
I REMEMBER ONCE YOU TOLD ME THE MEN WEAR OUT AN AVERAGE OF THREE PAIRS OF SAFETY SHOES AND TWO PAIRS OF SAFETY GOGGLES A YEAR
NOW FOR MAKING STEEL. THESE ARE OPEN HEARTH FURNACES. THE MOST WIDELY USED STEEL-MAKING PROCESS. INSIDE, THERE ARE HUGE BOWL-SHAPED CONTAINERS WITH HEAT RESISTING ROOFS. THEY'RE HEATED FROM THE ENDS BY FLAMES OF HIGH TEMPERATURE
IS STEEL MADE OF JUST HOT METAL?
THIS WILL ANSWER YOUR QUESTION, JIMMY. THAT GIANT RAMROD APPARATUS IS A CHARGING MACHINE. IT FIRST LOADS CAREFULLY WEIGHED AMOUNTS OF LIMESTONE, AND OTHER PURIFYING MATERIALS INTO THE FURNACE....
AND HERE COMES THE NEXT CHARGE....BOXES OF IRON AND STEEL SCRAP
I SEE. THE CHARGER ARM THRUSTS THE BOX INSIDE, THEN THE ARM TURNS AND DUMPS ITS LOAD
WHAT ARE THOSE PIPES LEADING TO THE FURNACE DOOR
WATER PIPES FOR COOLING, JIMMY. IN A DAY THE STEEL INDUSTRY USES ENOUGH WATER TO SUPPLY A CITY FOUR AND A HALF TIMES THE SIZE OF NEW YORK. THE GAS AND ELECTRICITY WOULD SUPPLY AROUND 16,000,000 HOMES
MOLTEN IRON IS ADDED NEXT— POURED INTO THE FURNACE BY A PORTABLE TROUGH
I REMEMBER. THAT'S THE IRON THAT'S KEPT IN THE MIXER

WHAT'S THIS, DAN? A TEST OF SOME KIND
YES. HE'S POURING A SAMPLE INTO A MOLD TO KEEP TRACK OF HOW THE BATCH OR "HEAT" IS COMING ALONG. THEN THE LABORATORY MAKES AN EXACT ANALYSIS

THE NEXT STEPS ARE TAPPING AND THEN POURING INTO INGOT MOLDS. BUT BEFORE WE WATCH THAT, I'D LIKE TO SHOW YOU TWO OTHER TYPES OF FURNACE. THE BESSEMER AND THE ELECTRIC
I HEARD ABOUT THE BESSEMER. OUR SCIENCE TEACHER SAID IT WAS THE FIRST MODERN STEEL-MAKING PROCESS
GOOD BOY, JIMMY!

WOW! LOOK AT THE FIREWORKS SHOOT UP. YOU COULD SEE THEM FOR MILES AT NIGHT!
THE BESSEMERS REALLY PUT ON A SHOW! THEY'RE TIPPED ON THEIR SIDES, CHARGED WITH MOLTEN IRON AND TURNED UP. AIR THEN IS BLOWN THROUGH THE IRON. OXYGEN IN THE AIR BURNS OUT THE IMPURITIES. THAT'S WHAT MAKES THE "FIREWORKS"

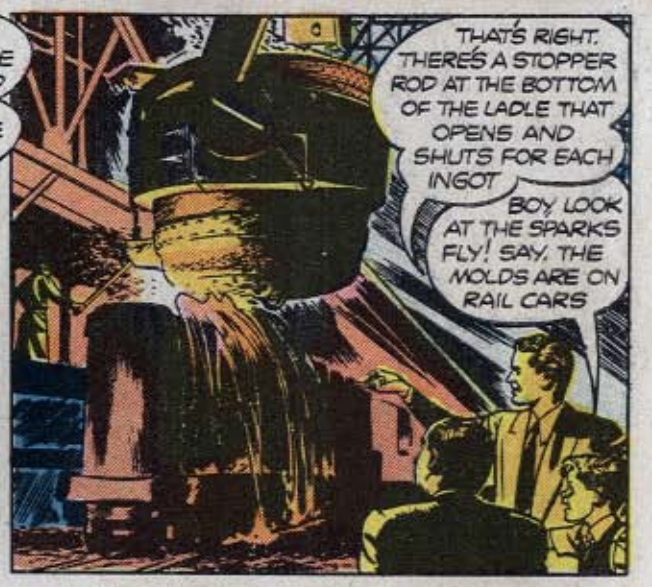
THAT BESSEMER PROCESS IS CERTAINLY SOMETHING TO SEE
NEXT WE'LL LOOK AT AN ELECTRIC FURNACE. THEY MAKE STAINLESS STEEL AND OTHER HIGH QUALITY STEELS. THEIR REFINING PROCESS CAN BE MORE CLOSELY CONTROLLED


THOSE BIG CARBON STICKS OR ELECTRODES EXTEND THROUGH THE FURNACE ROOF, DOWN CLOSE TO THE CHARGE OF METAL. WHEN THE CURRENT IS TURNED ON, ELECTRIC ARCS FURNISH THE HEAT FOR MELTING
IT'S HARD TO THINK HOW THEY INVENT ALL THOSE THINGS

AND NOW LET'S RETURN AND WATCH THEM TAP THE OPEN HEARTH. THE METAL FLOWS INTO A BIG LADLE, AND GOES FROM THERE TO THE INGOT MOLDS
IS THE OPEN HEARTH TAPPED IN THE SAME WAY AS THE BLAST FURNACE, DAN?

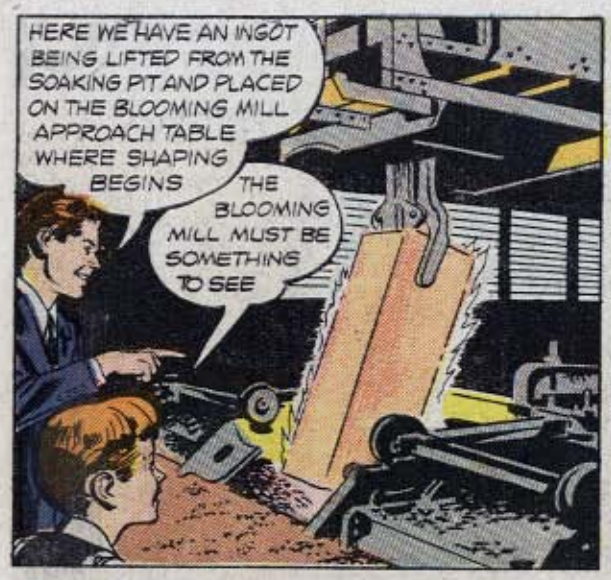
HERE'S THE ANSWER, MR. SMITH, WE'RE AT THE REAR OF THE FURNACE. A LONG BAR PASSING THROUGH THE FRONT HAS RAMMED THE PLUG OUT. THAT OVERFLOW VESSEL NEXT TO THE LADLE IS THE SLAG THIMBLE
I CATCH. THE SLAG IS LIGHTER AND FLOATS TO THE TOP, THEN SPILLS OVER INTO THE THIMBLE

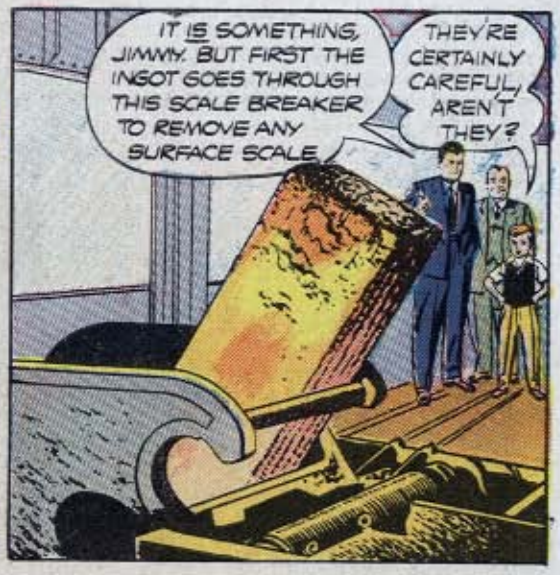
NOW WE'LL WATCH THE LADLE POUR THE INGOTS. SOMETIMES WE POUR AS MANY AS 25 INGOTS TO A BATCH OR HEAT. THE INGOTS RANGE FROM 5,000 TO 40,000 LB. EACH
A CRANE HOISTS THE LADLE ABOVE THE MOLDS, AND THE LADLE POURS FROM THE BOTTOM, EH

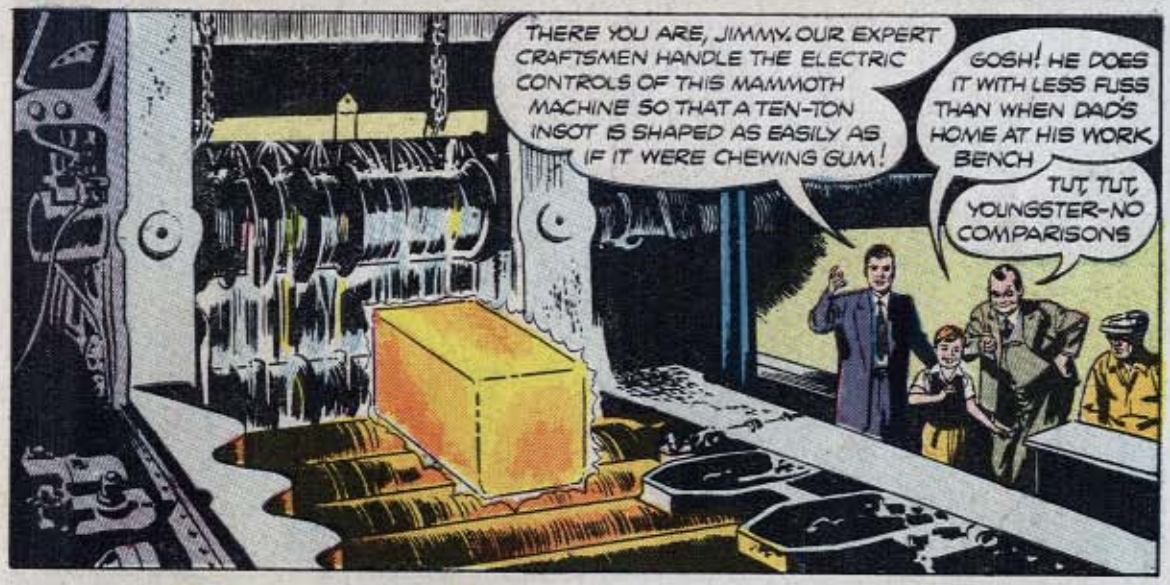

THAT'S RIGHT. THERE'S A STOPPER ROD AT THE BOTTOM OF THE LADLE THAT OPENS AND SHUTS FOR EACH INGOT
BOY, LOOK AT THE SPARKS FLY! SAY, THE MOLDS ARE ON RAIL CARS

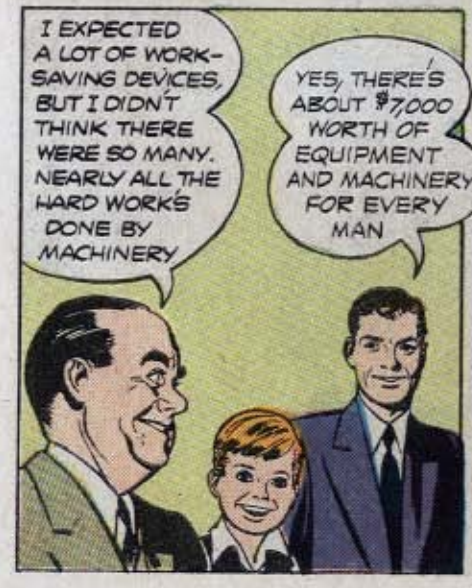
WE'LL JUST FOLLOW THE INGOT CARS TO WHERE THE STRIPPER CRANE PULLS THE MOLDS FROM THE INGOTS, JIMMY
SWELL

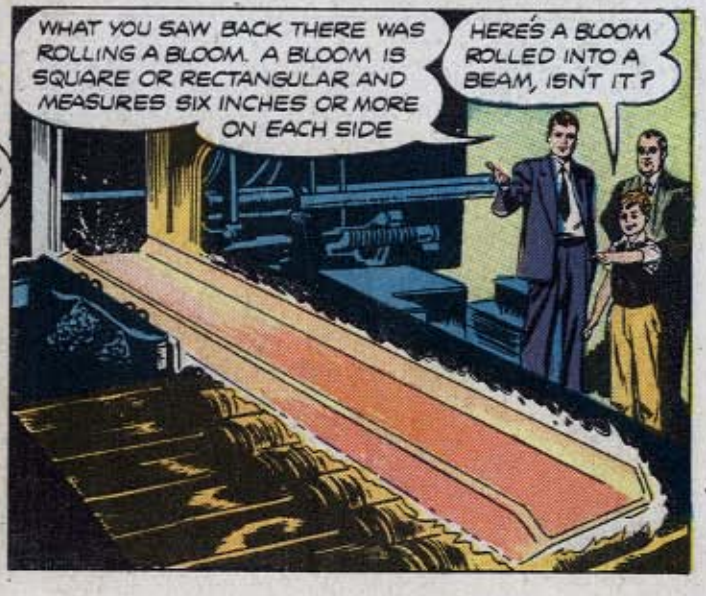
THOSE INGOTS REPRESENT A LOT OF STEEL ALL RIGHT
THE INDUSTRY'S 1,300 FURNACES CAN MAKE AS MUCH STEEL AS ALL THE REST OF THE WORLD COMBINED. NEXT STOP FOR THE INGOTS IS THE SOAKING PITS, WHERE GAS HEAT "SOAKS" THEM TO A UNIFORM TEMPERATURE THROUGHOUT


HERE WE HAVE AN INGOT BEING LIFTED FROM THE SOAKING PIT AND PLACED ON THE BLOOMING MILL APPROACH TABLE WHERE SHAPING BEGINS
THE BLOOMING MILL MUST BE SOMETHING TO SEE


IT IS SOMETHING, JIMMY. BUT FIRST THE INGOT GOES THROUGH THIS SCALE BREAKER TO REMOVE ANY SURFACE SCALE
THEY'RE CERTAINLY CAREFUL, AREN'T THEY?


THERE YOU ARE, JIMMY. OUR EXPERT CRAFTSMEN HANDLE THE ELECTRIC CONTROLS OF THIS MAMMOTH MACHINE SO THAT A TEN-TON INGOT IS SHAPED AS EASILY AS IF IT WERE CHEWING GUM!
GOSH! HE DOES IT WITH LESS FUSS THAN WHEN DAD'S HOME AT HIS WORK BENCH
TUT, TUT, YOUNGSTER-NO COMPARISONS


I EXPECTED A LOT OF WORK-SAVING DEVICES, BUT I DIDN'T THINK THERE WERE SO MANY. NEARLY ALL THE HARD WORK'S DONE BY MACHINERY
YES, THERE'S ABOUT $7,000 WORTH OF EQUIPMENT AND MACHINERY FOR EVERY MAN


WHAT YOU SAW BACK THERE WAS ROLLING A BLOOM. A BLOOM IS SQUARE OR RECTANGULAR AND MEASURES SIX INCHES OR MORE ON EACH SIDE
HERE'S A BLOOM ROLLED INTO A BEAM, ISN'T IT?

AND HERE'S A RAIL
RIGHT. THIS OPERATION IS THE "ROUGHING" MILL. THE RAIL NEXT GOES THROUGH ANOTHER MILL FIVE TIMES, THEN IT'S FINISHED BY A FINAL ROLL AND CUT TO LENGTH, USUALLY 33 OR 39 FT. THERE ARE AROUND 38,500,000 TONS OF RAILS IN THE NATION'S SERVICE

THIS IS A BAR MILL. FROM BILLETS, OR PIECES NOT OVER SIX INCHES SQUARE IN CROSS-SECTION, WE ROLL EVERY SHAPE OF STEEL BAR YOU CAN THINK OF FOR INDUSTRIAL PURPOSES
WHAT IS HEAVY STEEL PLATE MADE FROM, DAN?

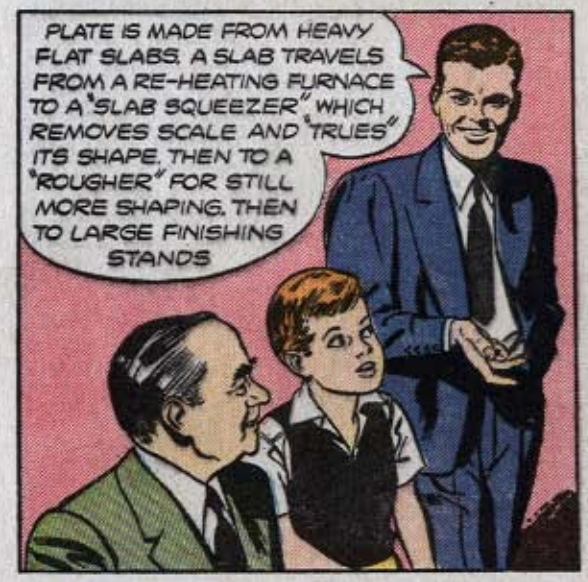
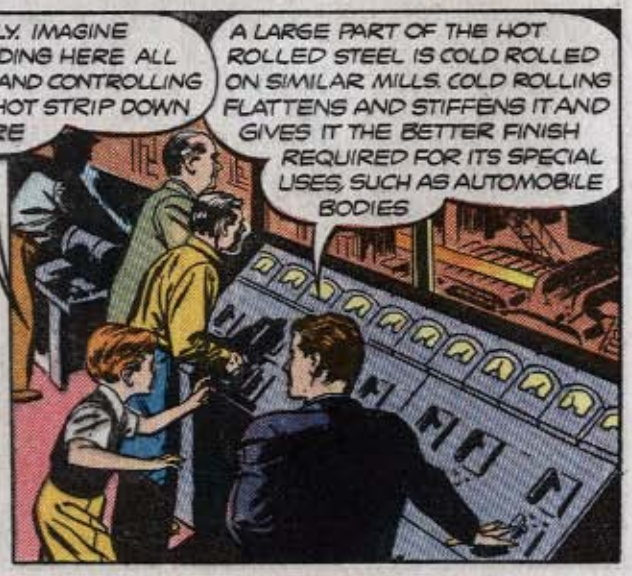


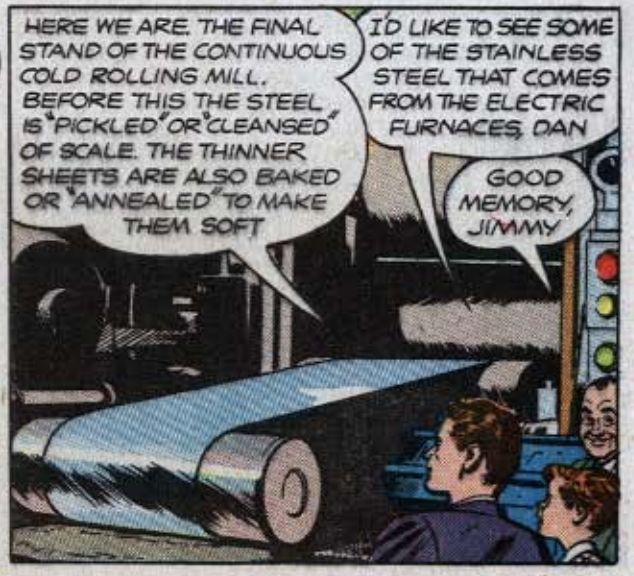
PLATE IS MADE FROM HEAVY FLAT SLABS. A SLAB TRAVELS FROM A RE-HEATING FURNACE TO A "SLAB SQUEEZER" WHICH REMOVES SCALE AND "TRUES" ITS SHAPE. THEN TO A "ROUGHER" FOR STILL MORE SHAPING. THEN TO LARGE FINISHING STANDS

HERE IT COMES FROM THE FINISHING STANDS, WHERE SPRAYS KEEP THE STEEL CLEAN AND HELP TO ADJUST ITS TEMPERATURE. EACH PLATE IS ROLLED TO DEFINITE ORDER. THAT PIECE WILL BE ABOUT 150 FT. LONG

WE'LL TAKE UP SHEET AND STRIP STEEL NEXT. WOULD YOU LIKE TO LOOK OVER A CONTROL CAB, JIMMY?
WOULD I!


GOLLY. IMAGINE STANDING HERE ALL SNUG AND CONTROLLING THAT HOT STRIP DOWN THERE
A LARGE PART OF THE HOT ROLLED STEEL IS COLD ROLLED ON SIMILAR MILLS. COLD ROLLING FLATTENS AND STIFFENS IT AND GIVES IT THE BETTER FINISH REQUIRED FOR ITS SPECIAL USES, SUCH AS AUTOMOBILE BODIES

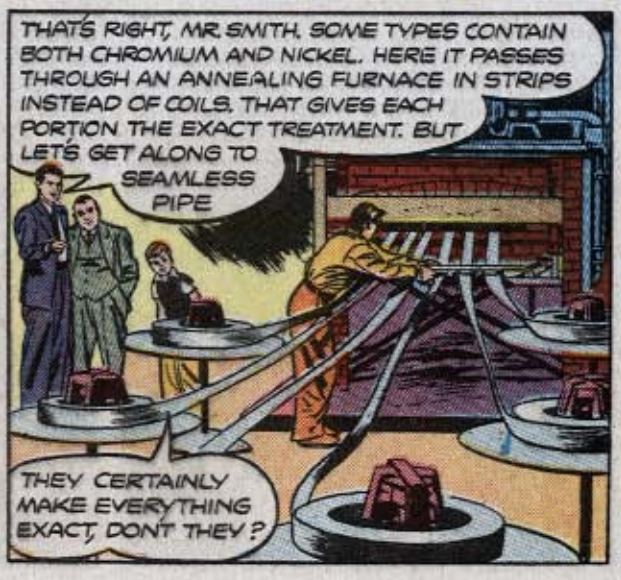
HOW THIN CAN THEY ROLL STEEL, DAN?
OUR EXPERTS CAN ROLL IT PAPER THIN ON SOME OF THE MILLS, JIMMY. LET'S WATCH A COLD ROLLING PROCESS


HERE WE ARE. THE FINAL STAND OF THE CONTINUOUS COLD ROLLING MILL. BEFORE THIS THE STEEL IS "PICKLED" OR "CLEANSED" OF SCALE. THE THINNER SHEETS ARE ALSO BAKED OR "ANNEALED" TO MAKE THEM SOFT
I'D LIKE TO SEE SOME OF THE STAINLESS STEEL THAT COMES FROM THE ELECTRIC FURNACES, DAN
GOOD MEMORY, JIMMY

WE'LL LOOK AT A TIN PLATE INSPECTION ON THE WAY, JIMMY. TIN PLATE IS SHEET STEEL CAREFULLY CLEANED AND COVERED WITH MOLTEN TIN. NEXT A SET OF ROLLS DISTRIBUTES THE TIN EVENLY. THEN COMES POLISHING AND INSPECTION
I DIDN'T KNOW THE BASE FOR TIN CANS WAS STEEL

HERE'S THE FINISHED PRODUCT. EVERY SHEET OF TIN PLATE PRODUCED BY THE STEEL INDUSTRY IS INSPECTED BY SPECIALLY TRAINED YOUNG WOMEN
WOMEN INSPECTORS! THAT'S WHY MOM KNOWS WHEN I'VE FUDGED ABOUT DOING SOMETHING RIGHT

NOW FOR STAINLESS STEEL. ITS IMPORTANT POINT IS SPECIAL HANDLING. THESE ARE HOT-ROLLED COILS TO BE FURTHER PROCESSED INTO COLD-ROLLED STRIPS
IT'S A TOUGHER STEEL, ISN'T IT, DAN?


THAT'S RIGHT, MR. SMITH. SOME TYPES CONTAIN BOTH CHROMIUM AND NICKEL. HERE IT PASSES THROUGH AN ANNEALING FURNACE IN STRIPS INSTEAD OF COILS. THAT GIVES EACH PORTION THE EXACT TREATMENT. BUT LET'S GET ALONG TO SEAMLESS PIPE
THEY CERTAINLY MAKE EVERYTHING EXACT, DON'T THEY?

SEAMLESS STEEL PIPE IS MADE BY ROLLS WHICH "SQUEEZE" A WHITE-HOT ROUND BAR TO MAKE THE INSIDE BREAK OPEN. THE ROLLS ALSO MOVE THE BAR OVER A PIERCING BAR TO KEEP THE HOLE UNIFORM IN SIZE
I GET IT. IT'S LIKE WORKING A GLOVE OVER YOUR FINGER

ANOTHER KIND OF PIPE IS WELDED UNDER PRESSURE. THE STRIP OR "SKELP" IS DRAWN WHITE-HOT THROUGH A BELL-SHAPED DIE THAT CURVES ITS EDGES TOGETHER MAKING A PERMANENT WELD AS YOU SEE HERE. THE INDUSTRY TURNS OUT TUBULAR PRODUCTS FOR EVERYTHING FROM HYPODERMIC NEEDLES TO OIL FIELD TUBING 8 FT. IN DIAMETER

THEN, THE USUAL INSPECTION, AFTER HYDRAULIC TESTS MUCH ABOVE THE PRESSURES REQUIRED IN SERVICE. LIKE TO SEE THEM MAKING WIRE?
YOU BET
TRY AND STOP US

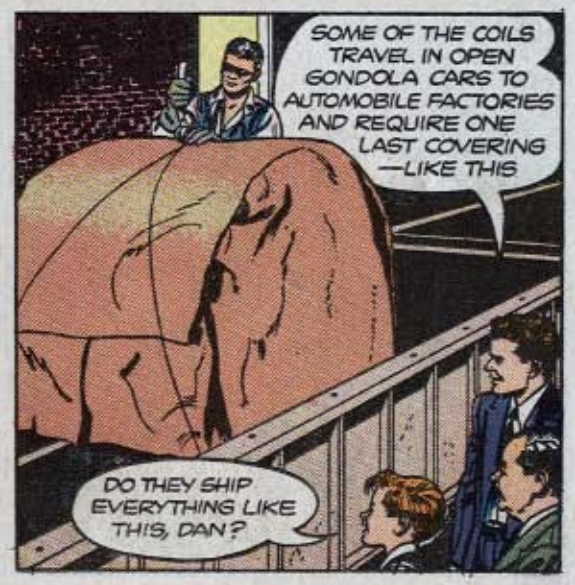
ABOUT 160,000 USES FOR STEEL WIRE HAVE BEEN RECORDED— FROM FENCES TO HAIR SPRINGS. A YEAR'S OUTPUT WOULD GO AROUND THE WORLD 6544 TIMES. HERE'S THE BEGINNING OF A COIL OF STEEL ROD BEING THINNED OUT THROUGH THE FIRST DIE
I SEE. THEN COME OTHER DIES, MAKING THE WIRE THINNER AND THINNER
YOWIE. 6544 TIMES AROUND THE WORLD!

THAT'S RIGHT. THIS MACHINE DOES SIX DRAWINGS. HEAVY STOCK ENTERS AT 70 FEET A MINUTE, AND LEAVES AT 400 FEET A MINUTE. HOW WOULD YOU LIKE TO SEE A MAN KNIT A WIRE FENCE, JIMMY?
HO, HO! YOU'RE KIDDING!

CREEPERS. BY HANDLING THE CONTROLS HE REALLY DOES KNIT FENCES
THAT'S THE GALVANIZED, RUST RESISTANT KIND UNCLE GEORGE HAS ON HIS FARM, JIMMY
IF YOU'LL COME THIS WAY, WE'LL GET AN OVER-ALL VIEW AT THE CONTINUOUS SHEET MILL WE WENT THROUGH. IT'S SOMETHING TO SEE. THEN WE'LL LOOK AT PACKAGING

THERE IT IS. ABOUT FOUR FOOTBALL FIELDS LONG, JIMMY. A LABOR SAVER AND A JOB CREATOR. THIS IS ALSO ONE OF THE MANY REASONS WHY STEEL IS CHEAP AT THE AVERAGE PRICE OF ONLY A FEW PENNIES PER POUND
YES, AND I THINK I READ SOMEWHERE RECENTLY THAT THIS KIND OF EQUIPMENT HELPS THE STEEL INDUSTRY OPERATE ON A VERY NARROW PROFIT MARGIN
BOY, THAT MACHINE IS REALLY WONDERFUL

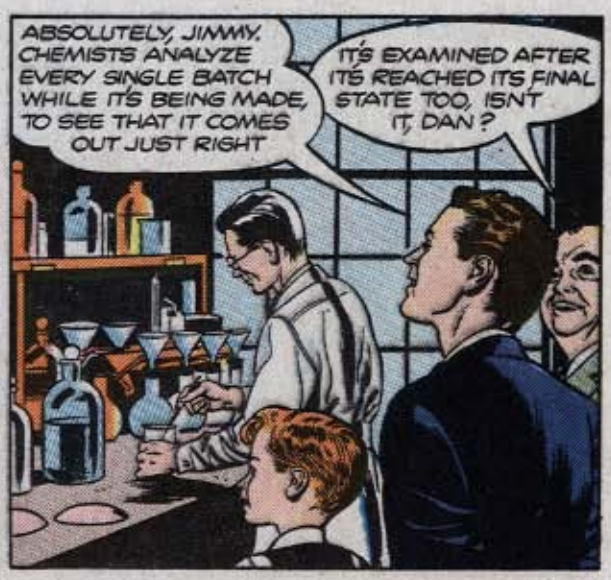
IN PACKAGING SHEET STEEL, WE FIRST PUT WATERPROOF, GREASEPROOF PAPER, TOUGH AS ELEPHANT'S HIDE, INSIDE THE COIL. THEN THE COIL GOES THROUGH A WEIGHING AND BINDING PROCESS
HOW DO THEY SHIP IT, DAN?


SOME OF THE COILS TRAVEL IN OPEN GONDOLA CARS TO AUTOMOBILE FACTORIES AND REQUIRE ONE LAST COVERING —LIKE THIS
DO THEY SHIP EVERYTHING LIKE THIS, DAN?

NO, BRIDGE GIRDERS AND THE LIKE ARE HANDLED BY SPECIAL CARS. AND SMALLER PACKAGED UNITS ARE HANDLED BY TRUCK AND TRAILER. LET'S LOOK INTO A BOX CAR

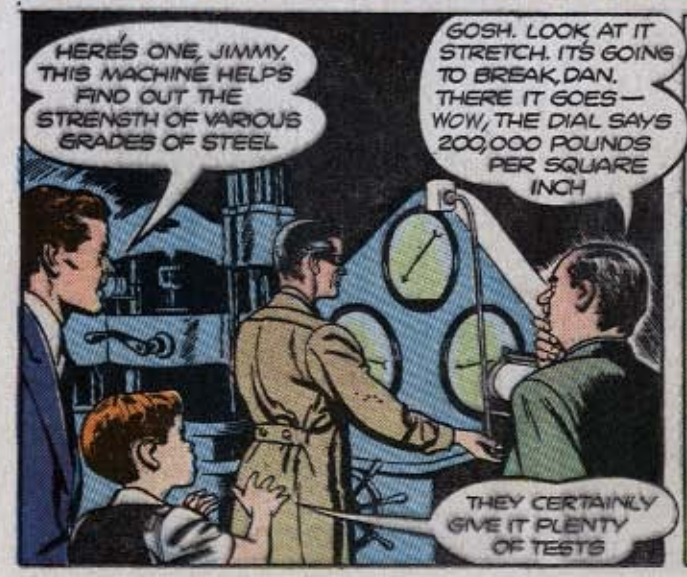
WHY THIS BOX CAR IS PRACTICALLY SCRUBBED!
THAT'S IT, MR. SMITH. THE STEEL IS PROTECTED FROM ANY SORT OF FOREIGN SUBSTANCE. THESE ARE JUST SOME OF THE MANY WAYS OF PACKAGING

I'VE KEPT A VERY IMPORTANT ITEM UNTIL LAST—THE LABORATORIES, AND THE RESEARCH SCIENTISTS WHO KEEP CLOSE WATCH ON EVERY ANGLE OF THE PRODUCT
IS THE STEEL EXAMINED ALL THE TIME DAN ?

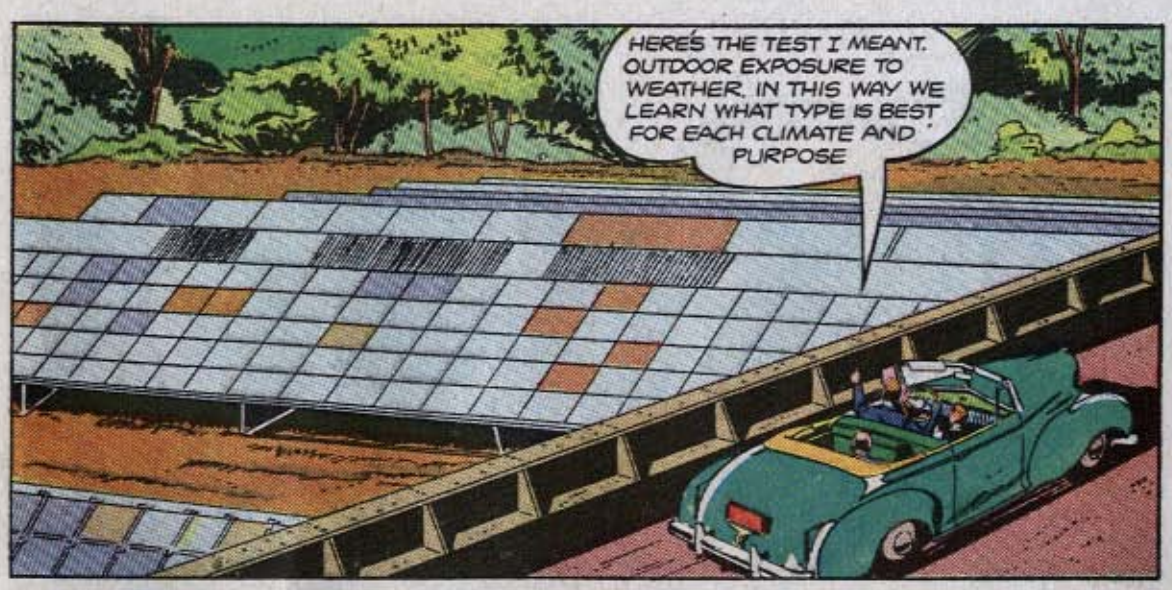

ABSOLUTELY, JIMMY. CHEMISTS ANALYZE EVERY SINGLE BATCH WHILE IT'S BEING MADE, TO SEE THAT IT COMES OUT JUST RIGHT
IT'S EXAMINED AFTER IT'S REACHED ITS FINAL STATE TOO, ISN'T IT, DAN ?

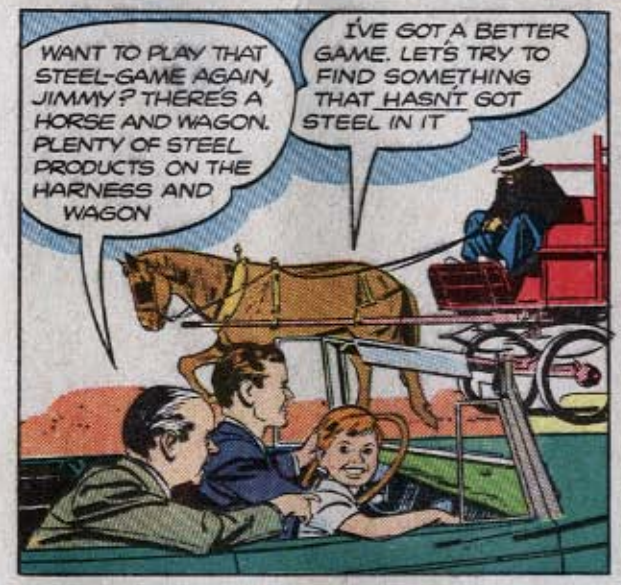
THAT'S RIGHT, MR. SMITH. HERE WE HAVE A BINOCULAR MICROSCOPE CHECKING TO FIND OUT JUST HOW FINE OR COARSE THE DIFFERENT TREATMENTS MAKE THE STEEL FOR DIFFERENT PURPOSES

AND HERE WE HAVE "HEAT TREATMENT" RESEARCH, TO STUDY THE DEVELOPMENT OF SPECIAL QUALITIES IN TYPES OF STEEL. THERE ARE ALSO TESTS FOR STRENGTH AND TOUGHNESS
GEE! I'D LIKE TO SEE ONE


HERE'S ONE, JIMMY. THIS MACHINE HELPS FIND OUT THE STRENGTH OF VARIOUS GRADES OF STEEL
GOSH. LOOK AT IT STRETCH. IT'S GOING TO BREAK, DAN. THERE IT GOES— WOW, THE DIAL SAYS 200,000 POUNDS PER SQUARE INCH
THEY CERTAINLY GIVE IT PLENTY OF TESTS

MORE TESTS THAN WE'LL HAVE TIME TO SEE, JIMMY, BUT WE'VE COVERED THE MAIN ITEMS OF STEEL-MAKING AND I'LL SHOW YOU ONE MORE TEST AS WE LEAVE
IT'S BEEN A LOT OF FUN, DAN, THANKS
GOSH, YES. THANKS





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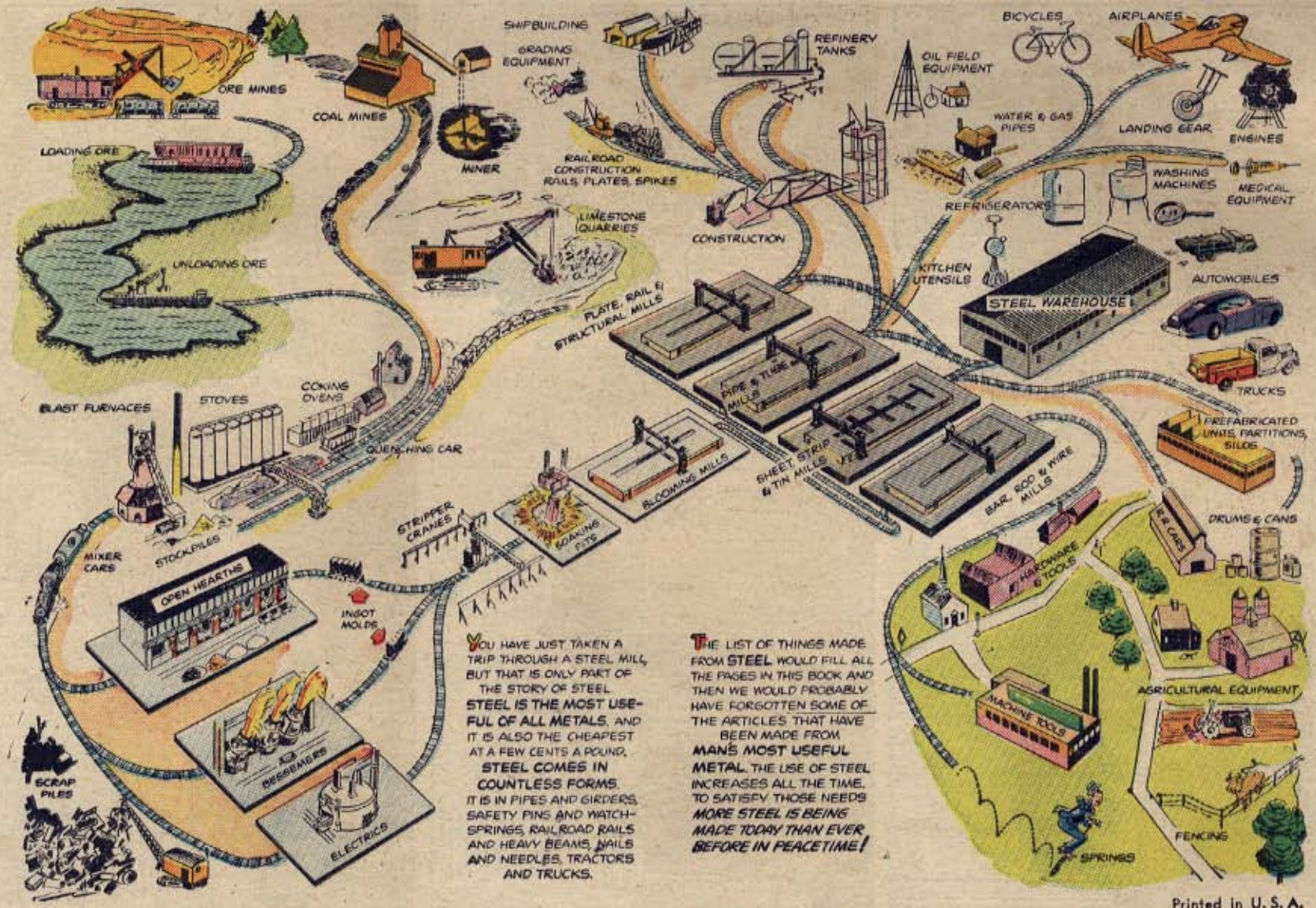

YOU HAVE JUST TAKEN A TRIP THROUGH A STEEL MILL, BUT THAT IS ONLY PART OF THE STORY OF STEEL. **STEEL IS THE MOST USEFUL OF ALL METALS**, AND IT IS ALSO THE CHEAPEST AT A FEW CENTS A POUND. **STEEL COMES IN COUNTLESS FORMS.** IT IS IN PIPES AND GIRDERS, SAFETY PINS AND WATCH-SPRINGS, RAILROAD RAILS AND HEAVY BEAMS, NAILS AND NEEDLES, TRACTORS AND TRUCKS.

THE LIST OF THINGS MADE FROM **STEEL** WOULD FILL ALL THE PAGES IN THIS BOOK AND THEN WE WOULD PROBABLY HAVE FORGOTTEN SOME OF THE ARTICLES THAT HAVE BEEN MADE FROM. **MAN'S MOST USEFUL METAL.** THE USE OF STEEL INCREASES ALL THE TIME. TO SATISFY THOSE NEEDS ***MORE STEEL IS BEING MADE TODAY THAN EVER BEFORE IN PEACETIME!***

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